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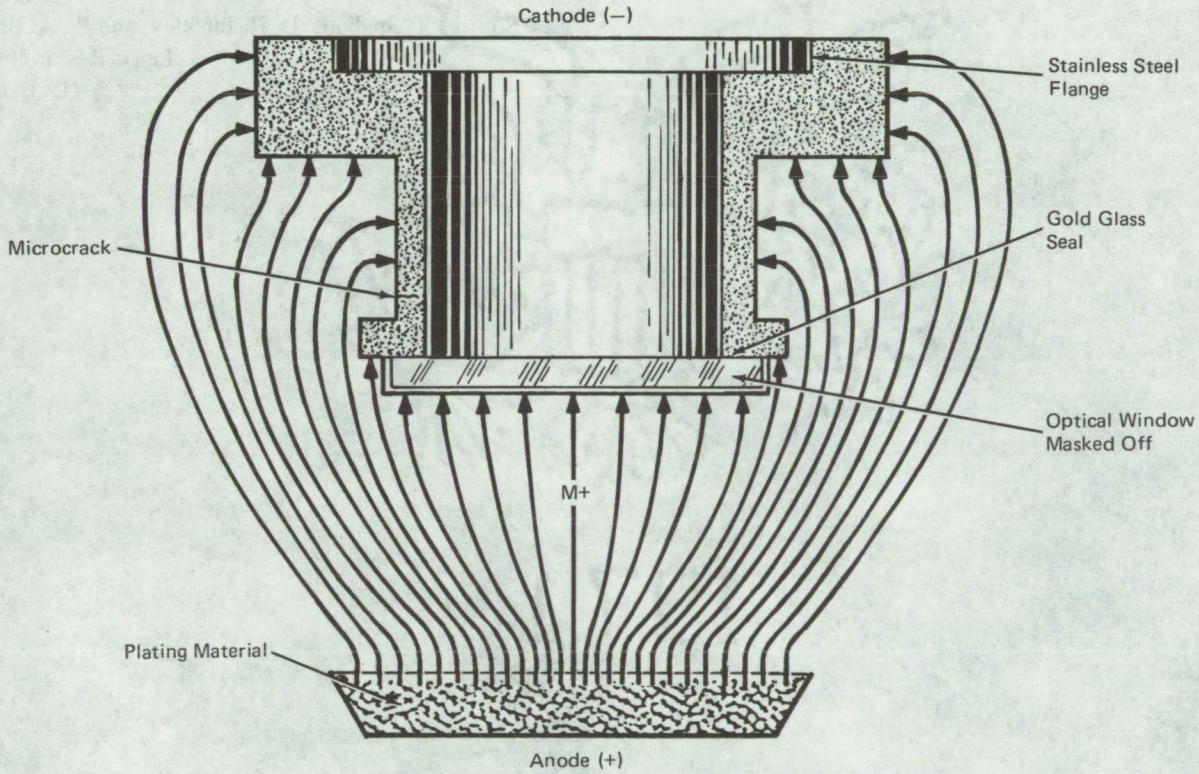
NASA TECH BRIEF

Lewis Research Center

Ion Plating Seals Microcracks or Porous Metal Components



Ion plating can be effectively used to seal-weld microcracks and porosity in functional metal components, which cannot be sealed by conventional welding techniques. A typical example is a high vacuum flange with a quartz optical window (see figure) in which a vacuum leak was detected close to the glass window. Conventional welding methods could not be used because of the high temperature effects and possible thermal stresses that would occur close to the glass window. Seal coatings such as epoxies cannot be used because they would contaminate the system due to degassing.

In ion plating, the plating metal source is made the anode and the part to be plated is made the cathode of the diode type dc-gas discharge. The glass window of the flange is masked off with an aluminum foil. A glow discharge is established using argon, and the plating metal is thermally evaporated into the glow discharge and ionized. The charged ions follow the electric lines of force to all points on the surface of the work piece regardless of its geometric shape (see figure). Due to its high energy, the ionized plating material penetrates deep into cracks and pores, and progressively bridges and fills these voids. A strong bond is obtained between the

(continued overleaf)

plating material and the plated surfaces. The entire workpiece is uniformly plated in one operation without being moved or rotated. The part to be coated can be plated at low temperature, thus avoiding thermal stresses.

In the example shown, the vacuum flange after being ion plated, was tested in ultra high vacuum and no leak was detected. The vacuum test detection sensitivity was 10^{-10} standard cm^3/sec of air.

To seal or fill porosity or microcracks in metals by ion plating, practically any plating metal or alloy can be selected, whereas, for conventional welding, materials selection is limited by compatibility.

Notes:

1. A more thorough description of the ion plating process is found in NASA Tech Brief 67-10006, "Complex Surfaces Plated by Thin-Film Deposition In One Operation".
2. No further documentation is available. Specific questions, however, may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B72-10397

Patent status:

No patent action is contemplated by NASA.

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